
This perspective article1 was very interesting and thought provoking; however, I was slightly skeptical about your conclusions in the section on neuromuscular relaxation. Specifically, I am having trouble reconciling my clinical experience with your suggestion that an increase in extensibility during a contract-relax procedure is due to a change in sensation. I acknowledge that an examiner’s perception can be misleading; however, I would be surprised if I were unwittingly applying more tension to gain more length (ie, the analog of the postintervention plot in Figure 2 of your article).

In particular, I regularly carry out contract-relax stretching on the piriformis muscle, which as I am sure you are aware, frequently becomes painful to palpation and shows increased tension in many instances of lumbosacral/pelvic dysfunction. Changes in passive medial (internal) rotation of 10 degrees or more can be obtained quite easily and without forcing the situation—most definitely counterproductive for most patients. It seems as though a shift of the tension/length graph must have taken place to the right; to achieve the same degree of thigh medial rotation as before treatment does appear to me to take less effort. Do you think this empirical observation can be rationalized in terms of the fact that the patients were symptomatic, as you note that the cited studies were carried out mostly in patients who were asymptomatic?

Jonathan B. Rohll
J.B. Rohll, BS (Biochemistry), BSc (Osteopathy), PhD, is Lecturer and Osteopath, Oxford Brookes University, Oxford, United Kingdom OX3 0BP. Address all correspondence to Dr Rohll at: jonathan.rohll@tesco.net.

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Reference


Author Response
I am pleased that you have taken the time to read our perspective article1 thoughtfully, and I appreciate your comments and question regarding contract/relax stretching.

The primary intent of our perspective article was to introduce the concept that increases in muscle extensibility observed after stretching can be due to modified sensation. This concept alone has profound implications regarding assessment of muscle extensibility and in understanding the biomechanical effects of stretching. While researching this topic, I found that there are a number of theories regarding muscle extensibility and stretching that are widely accepted as conventional wisdom but that are not supported by experimental evidence. Therefore, another underlying purpose of our article was to show how little basic research has been performed regarding these topics. What is presented in the perspective article is, to the best of my knowledge, accurate at this point in time. As with any scientific endeavor, as research continues, more evidence will likely come to light that will refine the ideas presented. I consider our article to be successful if it: (1) causes practitioners to question prevailing conventional wisdom, (2) encourages debate, and (3) inspires more research that helps to further understanding of these phenomena.

The neuromuscular relaxation section was written to show that increases in muscle extensibility can occur without any evidence of neuromuscular relaxation. We did not attempt to explain the biomechanical effect of contract/relax stretching in detail because this was not the focus of the article. However, we also did not intend to give the impression that all increases in muscle extensibility observed during contract/relax stretching are solely due to modified sensation.

I agree that, during performance of contract/relax stretching, a decreased resistance to stretch is palpable shortly after the isometric contraction is released. This decreased resistance has most often been attributed to neuromuscular relaxation. The experimental evidence available at this point in time, however, suggests instead that the decreased resistance is due to viscoelastic rather than neuromuscular relaxation.2–3

There are a number of studies that monitored electromyographic activity during contract/relax stretching and showed no evidence that neuromuscular relaxation was responsible for the observed increases in muscle extensibility.4–8 These studies evaluated several different stretching methods, and some authors6–8 observed that the greatest increases in muscle extensibility occurred with the stretching techniques that induced the greatest increases in electromyographic activity.
All of these studies\textsuperscript{4–8} questioned the traditional explanation that increases in muscle extensibility observed during contract/relax stretching (as well as stretches involving contraction of antagonist muscles) are due to neuromuscular relaxation induced by neuromuscular reflexes.

To my knowledge, there is only one study that additionally monitored passive torque during application of contract/relax stretching.\textsuperscript{2} That study was cited in our perspective article, and its results suggest that increases in extensibility (using subjects’ perception of pain onset as an endpoint) observed during contract/relax stretching can be attributed to both (1) temporary increases in muscle length (as illustrated in Fig. 1 of our article) due to viscoelastic deformation and (2) modified sensation (as illustrated in Fig. 2 of our article). The intent of the study by Magnusson et al\textsuperscript{2} was to examine the differences in electromyographic activity, passive torque, and stretch perception between a static stretch and a contract/relax stretch. During both the static stretch and contract/relax stretch conditions, muscles demonstrated: (1) viscoelastic stress relaxation of similar magnitude while being held in the initial stretched position and (2) a similar right shift of the torque/angle curves observed during the subsequent stretch application. Greater increases in muscle extensibility, however, were observed when subjects performed the contract/relax stretch versus the static stretch. The increases in extensibility that occurred in excess of those demonstrated with the static stretch could be attributed to modified sensation.

In clinical practice, the contract/relax stretch usually is repeated 3 to 5 times, allowing increasing end-range joint angles with each repetition. Magnusson and colleagues’ experiment\textsuperscript{2} was conducted using a single contract/relax stretch, and it would be valuable to see what occurs biomechanically when this technique is applied multiple times, as in clinical practice.

Magnusson and colleagues’ study\textsuperscript{2} was performed using hamstring muscles of male subjects who were healthy and asymptomatic. The biomechanical effect may vary in different muscles and subject groups. It is possible that neuromuscular relaxation may play a role in increasing the efficacy of contract/relax stretching in subjects diagnosed with neurological impairments or in subjects who are symptomatic, but, to my knowledge, this has not been shown experimentally. The isometric contraction itself may help to decrease pain in symptomatic muscles, further enhancing the increases in extensibility and reducing muscle guarding.

Thank you for your interest, comments, and question. I appreciate this opportunity to discuss the biomechanical effect of contract/relax stretching in some detail. Dr Magnusson and I chose to submit a correction, in part, to present this topic with more precision in the perspective article. The correction appears in the April issue of PTJ and can be found at: http://ptjournal.apta.org/cgi/content/full/90/4/647.

Cynthia Holzman Weppler
C.H. Weppler, PT, MPT, is Independent Researcher, Am Honigbaum 20, 65817 Niederjosbach, Germany. Address all correspondence to Ms Weppler at: mvmtscience@aol.com.

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